MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE UNDER POWER & ELECTRICITY DEPARTMENT, NOVEMBER, 2015

COMPUTER SCIENCE & ENGINEERING
PAPER - I

Time Allowed : 3 hours | Full Marks : 200

Attempt all questions.

Part A - Objective Type Questions (100 Marks)

All questions carry equal marks of 2 each.

*This Part should be answered only on the **OMR Response Sheet** provided.*

1. Regular expression are

(a) Type 0 language
(b) Type 1 language
(c) Type 2 language
(d) Type 3 language

2. If p = It is raining , q = She will go to college . "It is raining and she will not go to college" will be denoted by

(a) $p \wedge \sim q$
(b) $p \wedge q$
(c) $\sim (p \wedge q)$
(d) $\sim p \wedge q$

3. The statement $p \leftrightarrow q = (p \rightarrow q)(q \rightarrow p)$ describes

(a) Commutative Law
(b) Implication Laws
(c) Exportation Law
(d) Equivalence

4. The relation { (1,2), (1,3), (3,1), (1,1), (3,3), (3,2), (1,4), (4,2), (3,4)} is

(a) Reflexive
(b) Transitive
(c) Symmetric
(d) Asymmetric

5. What is the correct translation of the following statement into mathematical logic?
"Some real numbers are rational"

A. $\exists x (real(x) \vee rational(x))$
B. $\forall x (real(x) \rightarrow rational(x))$
C. $\exists x (real(x) \wedge rational(x))$
D. $\exists x (rational(x) \rightarrow real(x))$

(a) A
(b) B
(c) C
(d) D

6. A function of type f: $A \rightarrow A$, where f(x)=x and x is an element of A then, f on A is called

(a) Inverse function
(b) Identity function
(c) Modular function
(d) None of these

7. Difference between NFA and DFA depends only on
   (a) State
   (b) Final state
   (c) Transition function
   (d) None of these

8. Which of the following requires less memory?
   (a) DFS
   (b) BFS
   (c) Both (a) and (b)
   (d) None of these

9. Moore machine depends on
   (a) Input
   (b) Present State
   (c) Both (a) and (b)
   (d) None of these

10. A grammar of the form $A \rightarrow \alpha$, Where 'A' is a non-terminal (variable) and 'α' is combination of non-terminals and terminals (alphabet symbols) is called
   (a) Context sensitive
   (b) Context Free
   (c) Both (a) and (b)
   (d) None of these

11. A graph is called a _____ if it is a connected acyclic graph.
   (a) Cyclic graph
   (b) Regular graph
   (c) Tree
   (d) Not a graph

12. A minimal spanning tree of a graph G is
   (a) A spanning sub graph
   (b) A tree
   (c) Minimum weights
   (d) All of these

13. In how many ways can 5 balls be chosen so that 2 are red and 3 are black?
   (a) 910
   (b) 990
   (c) 970
   (d) 960

14. What is a digital-to-analog converter?
   (a) It takes the digital information from an audio CD and converts it to a usable form.
   (b) It allows the use of cheaper analog techniques, which are always simpler.
   (c) It stores digital data on a hard drive.
   (d) It converts direct current to alternating current.

15. To implement the expression ABCD + ABCD + ABCD, it takes one OR gate and
   (a) three AND gates and three inverters
   (b) three AND gates and four inverters
   (c) three AND gates
   (d) one AND gates

16. How is a J-K flip-flop made to toggle?
   (a) J = 0, K = 0
   (b) J = 0, K = 1
   (c) J = 1, K = 0
   (d) J = 1, K = 1

17. Dynamic input is related to
   (a) S-R flip flop
   (b) J-K flip flop
   (c) T flip flop
   (d) All of these

18. Difference between state table and excitation table is
   (a) Excitation table has flip-flop inputs
   (b) State table has flip-flop inputs
   (c) No differences
   (d) None of these

19. Which logic circuit is the fastest?
   (a) DTL
   (b) TTL
   (c) RTL
   (d) All have same speed

20. The main advantage of flip-flops over transistor circuit is

(a) immunity from noise
(b) low heating
(c) low propagation delay time
(d) high propagation

21. The logical expression y=A+A'B is equivalent to

(a) y=AB
(b) y=A'B
(c) y=A'+B
(d) y=A+B

22. The K-map for a Boolean function is shown in figure. The number of essential prime implicants for this function is

	AB				
CD		**00**	**01**	**11**	**10**
	00	1	1	0	1
	01	0	0	0	1
	11	1	0	0	0
	10	1	0	0	1

(a) 4
(b) 5
(c) 6
(d) 8

23. For a binary half sub tractor having two inputs A and B, the correct set of logical expressions for the outputs D (= A minus B) and X (= borrow) are

(a) $D = AB + AB,\ X = \overline{A}B$

(b) $D = AB + AB + A\overline{B},\ X = A\overline{B}$

(c) $D = AB + A\overline{B},\ X = \overline{A}B$

(d) $D = AB + \overline{AB},\ X = AB$

24. The technique where the controller is given complete access to main memory is

(a) Cycle stealing
(b) Memory stealing
(c) Memory mode
(d) Burst mode

25. An interrupt that can be temporarily ignored is

(a) Vectored interrupt
(b) Non-maskable interrupt
(c) Maskable interrupt
(d) High priority interrupt

26. Pipe-lining is a unique feature of

(a) RISC
(b) CISC
(c) IANA
(d) ISA

27. The number of failed attempts to access memory, stated in the form of fraction is called as

(a) Hit rate
(b) Miss rate
(c) Failure rate
(d) Delay rate

28. A simple way of performing I/O tasks is to use a method known as

(a) program-controlled I/O
(b) program-controlled input
(c) program-controlled output
(d) I/O operation

29. What are the minimum number of 2-to-1 multiplexers required to generate a 2-input AND gate and a 2-input Ex-OR gate?
(a) 1 and 2
(b) 1 and 3
(c) 1and 1
(d) 2 and 2

30. EPROM contents can be erased by exposing it to
(a) Infrared rays
(b) Burst of microwaves
(c) Ultraviolet rays
(d) Intense heat radiations

31. If MSB of a mantissa in a floating point number is non-zero
(a) Number is normalized
(b) Number is negative
(c) Number is positive
(d) None of these

32. If there are four 4-bit registers that need to communicate with a 4-line common bus, the number of 4X1-Multiplexer required is
(a) 2
(b) 4
(c) 8
(d) None of these

33. Memory reference instruction may consist opcode and
(a) Address
(b) Register operation information
(c) Input-output operation
(d) None of these

34. Which of the following is not part of instruction cycle?
(a) Fetch
(b) Write
(c) Decode
(d) Execute

35. BCD of 761 is
(a) 011101100001
(b) 1111101
(c) 0111110001
(d) None of these

36. The DMA controller transfers one data word at a time and after that it returns control of the buses to the CPU is known as
(a) Bus grant
(b) Burst transfer
(c) Cycle stealing
(d) None of these

37. When an unit receives data it responded with another control signal to acknowledge the receipt of the data, this is known as
(a) Strobe
(b) Interrupt
(c) Polling
(d) Handshaking

38. The fast transfer of information between magnetic disks and memory can be done by
(a) Interrupt vector
(b) DMA transfer
(c) Polling
(d) None of these

39. A number of independent programs can be processed concurrently by CPU, it is called
(a) Multitasking
(b) Multiprogramming
(c) Multi threading
(d) None of these

40. A logically related instructions or data elements associated with a name is called
(a) Logical address
(b) Page
(c) Segment
(d) None of these

41. A union find data-structure is commonly applied while implementing
    (a) A depth-first search traversal of a graph
    (b) A breadth-first search traversal of a graph
    (c) The computation of the minimum spanning tree of a graph
    (d) The computation of the all-pairs shortest path in a graph

42. Which of the following algorithm uses 'divide and conquer' strategy?
    (a) Insertion sort
    (b) Quick sort
    (c) Shell sort
    (d) Selection sort

43. Which of the following is the tightest upper bound that represents the number of swaps required to sort n numbers using selection sort?
    (a) $O(\log n)$
    (b) $O(n)$
    (c) $O(n \log n)$
    (d) $O(n2)$

44. A priority queue is implemented as a Max-Heap. Initially, it has 5 elements. The level-order traversal of the heap is: 10, 8, 5, 3, 2. Two new elements 1 and 7 are inserted into the heap in that order. The level-order traversal of the heap after the insertion of the elements is
    (a) 10, 8, 7, 3, 2, 1, 5
    (b) 10, 8, 7, 2, 3, 1, 5
    (c) 10, 8, 7, 1, 2, 3, 5
    (d) 10, 8, 7, 5, 3, 2, 1

45. Let P be a QuickSort Program to sort numbers in ascending order using the first element as pivot. Let t1 and t2 be the number of comparisons made by P for the inputs {1, 2, 3, 4, 5} and {4, 1, 5, 3, 2} respectively. Which of the following holds?
    (a) t1 = 5
    (b) t1 < t2
    (c) t1 > t2
    (d) t1 = t2

46. When inorder traversing a tree resulted E A C K F H D B G; the preorder traversal would return
    (a) FAEKCDBHG
    (b) FAEKCDHGB
    (c) EAFKHDCBG
    (d) FEAKDCHBG

47. Which of the following is not height-balanced tree?
    (a) AVL Tree
    (b) B-Tree
    (c) Read-black Tree
    (d) None of these

48. Performance of an algorithm is determined by
    (a) Space
    (b) Time
    (c) Bothe (a) and (b)
    (d) None of these

49. Worst case complexity of the algorithm to insert an element into a list is
    (a) $O(n^2)$
    (b) O(n)
    (c) O(lgn)
    (d) None of these

50. Selection and Insertion sort are similar in respect of
    (a) Asymptotic complexity
    (b) Non recursive
    (c) Non-linear operation
    (d) None of these

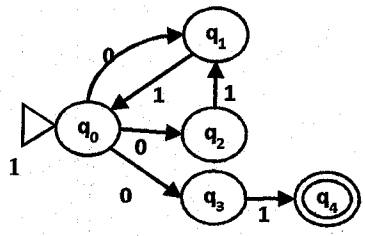
Part B - Short Answer Questions (100 Marks)

All questions carry equal marks of 5 each.

*This Part should be answered only on the **Answer Booklet** provided.*

1. Construct a Mealy machine which can output EVEN, ODD according to the total number of 1's encountered is even or odd. The input symbols are 0 and 1.
2. Consider the following real variables form everyday life
   (a) Income measured in Indian rupees.
   (b) Speed measured in kilometers per hour.
   (c) A TV show measured in how much you are interested in watching it.
   (d) A meal measured in how much you like to eat it.
   (e) A traffic light measured in what colour is on.

   In each case, suggest a fuzzy variable corresponding to these to these real variables.
3. Explain with example the Prim's shortest spanning tree algorithm.
4. Convert the following NFA to DFA.



5. With examples briefly state two addresses and three address instructions.
6. Give the basic circuit of a 3 input TTL NAND logic and explain briefly its operation.
7. Design a decade counter using 4 "T" flip flops. You must give the state table along with excitation inputs required and minimize the logic and realize.
8. Find the expression for sum and carry for binary full adder. Draw the logic diagram.
9. Give the truth table of S-R and D-flipflops. Convert the given S-R flipflop to a D-flipflop.
10. Differentiate hardwired control and micro-programmed control.
11. Describe virtual memory address translation with a block diagram.
12. What are the different modes of I/O transfer? Explain.
13. Discuss any five ways of improving the cache performance.
14. Analyse the complexity of binary search algorithm.
15. Is minimum spanning tree helpful to find shortest path in a graph? Justify with example.
16. State at least five differences between DFS and BFS.
17. What is a priority queue? Explain with an example.
18. Consider the following set of data 30, 60,50,40,10,70,20,80,90,1. Construct a B-tree of order 3 and insert them in the order as they appear.
19. Construct an AVL tree using the following keys (show each step)
    (a) 9,14,6,23,8,11,5,24,1,77,52,3,10,38,40,2
    (b) Delete the following keys : 23,5,52,10
20. Analyse the worst case complexity of Quick sort algorithm.

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